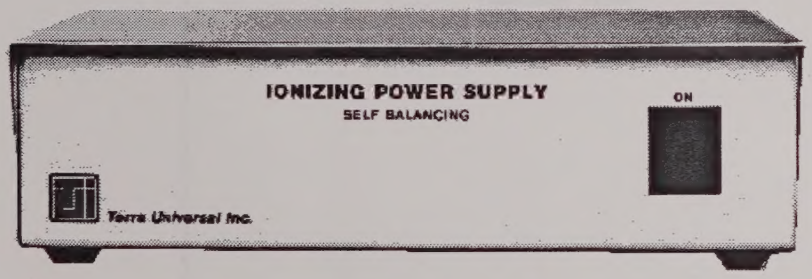
OPERATING MANUAL

Terra Universal
Ionizing Equipment:

Automatic IonWatch™ Power Supply
Ionizing Nozzles
Ionizing Bars



Terra Universal Inc.

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CAUTION!!!:
When installed and operated properly, ionizing equipment will safeguard sensitive equipment against ESD (electrostatic discharge). When misused, however, this equipment can lead to serious damage of stored materials.

The warning **CAUTION!!!** appears throughout this manual to alert you to possible dangers involved in setting up and operating this equipment. By paying careful attention to these warnings, you can avoid the most common causes of damage to delicate stored material.

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1.0 Introduction: Why all the Static?

Static electricity—defined as an excess or deficency of electrons on a surface—has plagued the semiconductor manufacturing industry ever since the advent of integrated circuitry. Its effects pose especially serious problems to today's miniaturized, sophisticated, and expensive components.

Electrostatic Discharge (ESD) occurs when an accumulated charge (which may be present on an operator, the operator's clothing, or on any other nonconductive object) is discharged through a conductor (which may be part of a wafer, a chip, or a packaged device).

Two Methods for Controlling Electrostatic Discharge (ESD)
Generally speaking, a static-control program must seek to eliminate ESD by preventing the buildup of static charge whenever possible and by ensuring quick, reliable removal of already existing charges.

TUI has developed a full line of products for both static-control strategies. To prevent static buildup, we have designed a number of storage systems around the Faraday concept, which guarantees 100% ESD protection within a stainless steel enclosure. All of our stainless steel conductive trays and shelves, as well as our complete line of Faraccators and automated storage systems, provide this protection. In addition, our Static Dissipative PVC Plating helps prevent ESD by combining all of the advantages of plexiglass (light weight, optimal visibility, excellent malleability) with static dissipative properties that prevent buildups of surface charge.

But these methods of static control aren't right for every application. In many cases, you may need to remove—to *neutralize*—static charges that already exist on a surface. Conductive surfaces can be neutralized through proper grounding, but charges on nonconductive surfaces (such as plastic boxes and many waffle packs) can only be removed through the neutralizing effect of free ions. In other cases (such as under TUI's Vertical Laminar Flow station), the Faraday concept is impractical; only free ions can guarantee a static-safe working conditions. And plexiglass—which is still the most common material for desiccator cabinets—generates static charges that often cannot be shielded out by a conductive Faraday cage. Large assemblies, for example, may not fit inside TUI's conductive trays and shelves. For all of these reasons, TUI offers ionizing equipment.

Ionization: Dual Static Protection
Ionizing nozzles and bars remove static charges by emitting large quantities of balanced positive and negative ions. Any existing surface charges attract ions of the opposite polarity, which neutralize

the net charge. Static decay times are directly related to the number of air-borne ions: the more negative ions, the faster the decay time for positive charges (and vice versa).

By installing ionizing nozzles in each desiccator compartment, you can effectively neutralize surface charges within that compartment. Ionizing bars deliver this same protection in ASD systems, laminar flow stations, glove boxes and hoods. This equipment thus performs a dual function: it eliminates the build-up of static charges that can damage sensitive materials, and it also neutralizes charges the already exist on materials placed into the desiccator or work station.

CAUTION!!!:
Only a self-balancing ionizing power supply like TUI's IonWatch can guarantee the complete safety of sensitive components. Conventional high-energy AC power supplies are perfectly suitable for use with ionizing guns, but in a desiccator their high-energy output can generate ozone and radio frequency interference. Pulsating DC power units present a different set of problems: because they generate separate streams of positive and negative ions through separate nozzles, they must be carefully balanced and maintained in order to avoid a charge imbalance.

Only the self-balancing, pulse-width modulated IonWatch eliminates these problems by providing a steady, balanced stream of ions through each ionizing nozzle.

2.0 Equipment Description

2.1 Ionizing Nozzles

TUI ionizing equipment consists of an Automatic IonWatch Ionizing Power Unit and either Ionizing Nozzles or an Ionizing Bar.

In TUI desiccators, ionizing nozzles are installed on the plenum chamber wall. As nitrogen is fed into the desiccator, the nozzles break up the gas molecules that pass through them into positive and negative ions. These ions then remove static electricity by combining with surface charges of the opposite polarity.

All nozzle hardware is made of oxidation- and contamination-proof materials. Nozzles require the IonWatch Power Unit, a Power Cable Extension, and an Ionizer Coupling (see Section 3.1 for descriptions of couplings and power cable extensions).

NOTE: Ionizing Power Supplies #2003-01 (110VAC) and #2303-03 (220VAC) deliver the proper ionizing power for desiccators. These are the only power supplies available that can be safely operated with materials positioned as close as 1" from an ionizing nozzle. Select the higher-flux power supplies no. 2003-02 (110VAC) or 2003-04 (220VAC) for use with laminar flow stations, hoods, glove boxes and Auto-Strat Desiccators (see section 2.2).

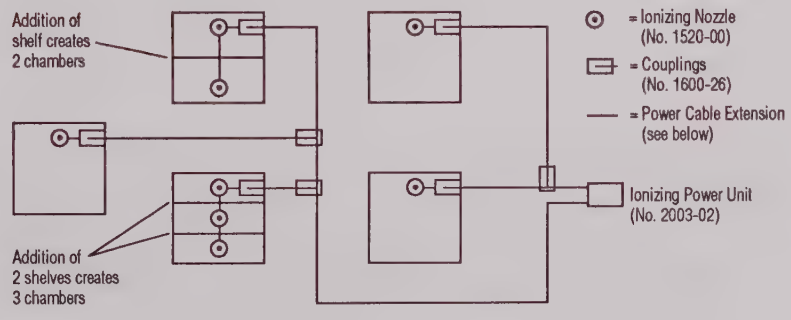

Addition of shelf creates 2 chambers
= Ionizing Nozzle (No. 1520-00)
= Couplings (No. 1600-26)
= Power Cable Extension (see below)
Ionizing Power Unit (No. 2003-02)
Addition of 2 shelves creates 3 chambers

Figure 2.1
Typical Ionizing Nozzle Application

Each desiccator compartment requires a single ionizing nozzle, which emits a balanced charge of positive and negative ions. Because free ions will not pass from one chamber to another, a separate nozzle must be installed in each chamber, even if chambers are separated by perforated shelves.

This means that a new nozzle becomes necessary each time you add a shelf—even a perforated shelf—to a desiccator because each shelf creates a new compartment. A single power unit can drive many nozzles (see information on power units below).

NOTE: Because each nozzle requires a steady stream of gas to provide the ion source, nozzles can be installed only on desiccator cabinets which feature a plenum wall.

2.2 Automatic IonWatch™ Ionizing Power Units

The Automatic Ion Watch Ionizing Power Unit delivers the high voltage necessary to break the gas molecules that are fed to the nozzles into positive and negative ions.

This pulse-width modulating power supply combines the advantages of AC and DC systems with none of the problems. Unlike conventional AC equipment, it delivers relatively low output voltage, so it creates no problems with ozone or RFI. And unlike pulsating DC equipment, it emits both positive and negative ions through a single nozzle so that even parts placed directly adjacent to the nozzle will not be charged positively or negatively.

In addition, it is completely self-balancing—you don't need to worry about a charge imbalance developing over time that could threaten sensitive materials. A remote sensor placed in one of the desiccator compartments, or on the ionizing bar, continuously monitors the net charge and enables the unit to modulate the ionizng pulse width—the balance of positive and negative ions—in accordance with changing environmental conditions. Should a net charge of either polarity ever develop, the feedback capacitor will sense the imbalance and direct the power unit to emit an excess number of ions of the opposite polarity until the charge is neutralized.

NOTE: Make sure that you order ionizing power supply #2003-02 (110VAC) or 2003-04 (220VAC) for use in laminar flow stations, hoods, gove boxes, and other applications that require greater ionizing power to distribute ions over a large area. The lower-flux power supplies (2003-01 and 2003-03) are appropriate for applications inside a desiccator, where less ionizing power is required.

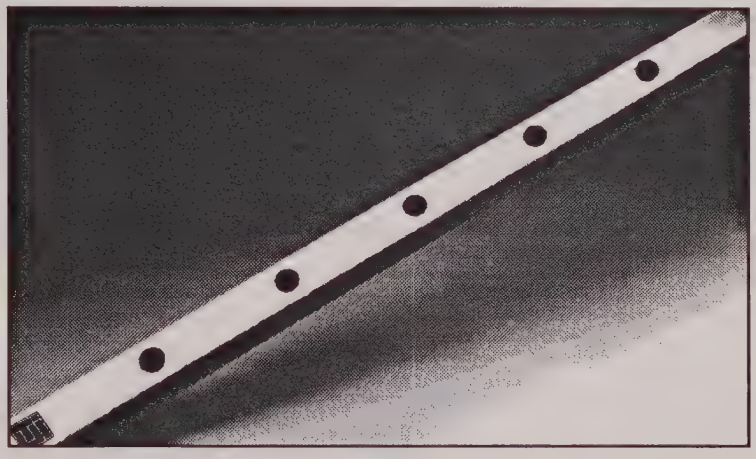
One Automatic IonWatch Power Unit can typically operate up to 24 nozzles. Periodic testing is recommended to ensure satisfactory operation. Refer to "Maintenance" below for testing procedures.

Applications with AC Ionizing Power Supply (Cat. No. 1600-09) TUI's AC Ionizing Power Supply is intended for use with the Clean Room Ionizing Air Gun (Cat. No. 2625-00) only. In this application it poses no threat to static-sensitive materials. It should not, however, be used to operate ionizing nozzles in a desiccator or other enclosure because its high-energy output can generate ozone and/or RFI.

2.3 Ionizing Bars

Ionizing Bars are designed to provide electrostatic protection in TUI's Vertical Laminar Flow Stations, glove boxes, ASD systems, Universal Hoods, and other large work stations. They incorporate ionizing nozzles like those described above, but the nozzles are built into a noncontaminating aluminum bar, which must be mounted on the upper inside surface of the work station. The laminar flow created by the work station then carries the ions downwards onto the work surface to neutralize static charge build-ups.

Figure 2.3
Ionizing Bar



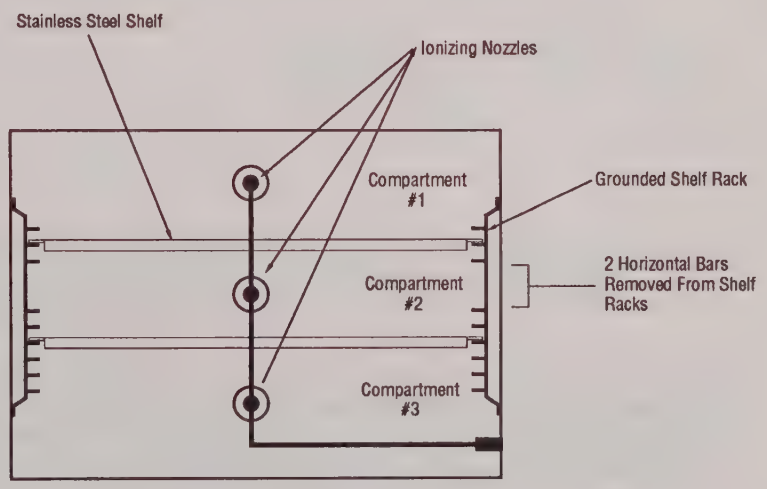
Ionizing Bars, like nozzles, are powered by the Automatic IonWatch Power Supply, which generates the energy necessary to create a balanced supply of positive and negative ions. The power unit can be mounted inside the work station (in which case all controls will be incorporated into the station's main control panel), or else operated as a separate unit.

3.0 Check-Out and Installation

Terra Universal factory installs all required ionizing nozzles. Because improper nozzle installation can damage desiccator walls or lead to charge imbalances during operation, you should not attempt to install them yourself; contact TUI for information on retrofitting ionizing nozzles.

NOTE: Remember: the addition of a shelf may require an additional nozzle. Either plan your shelf placement to avoid the necessity of later retrofitting, or keep only nonstatic-sensitive parts in chambers you create when you add a shelf.

CAUTION!!!:
You should take care not to place a grounded stainless steel shelf next to a nozzle or a shock hazard may result. If your desiccator makes use of grounded shelves, you may have to modify the shelf racks (by removing one or more bars) to eliminate the possibility of a shelf being placed adjacent to an ionizing nozzle.



Rear View of Desiccator Cabinet with two stainless-steel shelves (3 compartments)

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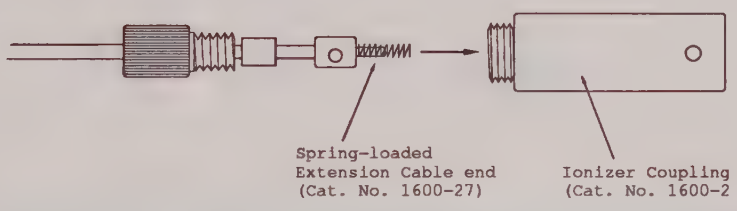
Figure 3.1
Safety Modified Shelf Racks

3.1 Ionizing Couplings and Power Cable Extensions

TUI Ionizer Couplings (Cat. No. 1600-26) and Power Cable Extensions (Cat. No. 1600-27 through 1600-30) allow you to drive many ionizing nozzles from a single power unit. Each power unit features two independent ion output ports on the rear panel. For best results, use each output to power roughly the same number of nozzles, as shown in Figure 3.2.

Each power extension consists of a high voltage cable and a spring-loaded cable connector at both ends. Connectors are easily attached either to an Ionizer Coupling or to a power unit receptacle; simply insert the spring-loaded end and turn the knurled knob clockwise to tighten (see Figure 3.2).

Fig. 3.2
Attaching a Power Cable Extension



TUI Ionizer Couplings provide a terminal for plenum chamber ionizing nozzles or can be used as a junction box for branching off further power cable extensions.

To branch off from a power cable extension, you must first remove one of the spring-loaded end connections with an Allen wrench (not included). Then, the plastic bushing and tightening knob can be removed, and the cable can be inserted through the ionizer coupling. Once this is done, re-attach the end connector (see Figure 3.3).

A wood screw inserted into the coupling pierces the cable wire to make connection with the other cable.

CAUTION!!!:
If the screw is installed too far, it can break the wire of cable #1. You should conduct a continuity test each time you make this connection to make sure that the wire is not damaged. To test, connect the probe of the continuity tester to the electode feeding into the branch and then test each end of cable #1.

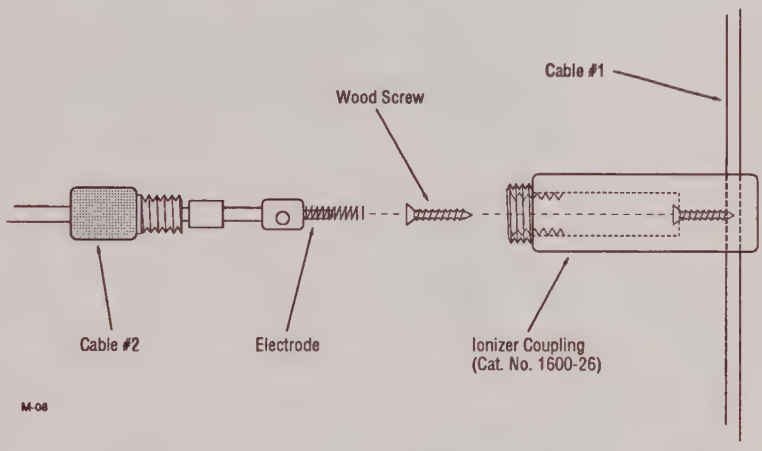


Figure 3.3
Branching from a Power Cable Extension

3.2 Installing the Automatic IonWatch Power Supply

The Automatic IonWatch Power Supply features two output power terminals. Each delivers a balanced charge; you can use either (or both) terminals in setting up your desiccator or other enclosure.

When your equipment is delivered, you should visually inspect the desiccator cabinet to ensure that all ionizing nozzles are securely attached to the plenum chamber wall.

To set up the system,

1. Use the Ionizer Couplings and Power Cable Extensions to connect the ionizing nozzles to the power unit (see Section 3.1 above). Connections will depend on the number of nozzles you are operating (a single Power Unit can drive up to 24 nozzles).

2. Desiccators are shipped with the sensor plate mounted on a nozzle located near the top of the plenum chamber. You simply need to attach the connecting wire from the top the cabinet to the rear of the ionizing power unit. See Figure 3.4.

   Only one sensor is required for each of these power units. It monitors the net charge emitted through the nozzles and

allows the power unit to correct any charge imbalance that might develop.

3. Connect the 3-pronged power plug to a grounded 120VAC power outlet and turn the unit ON.

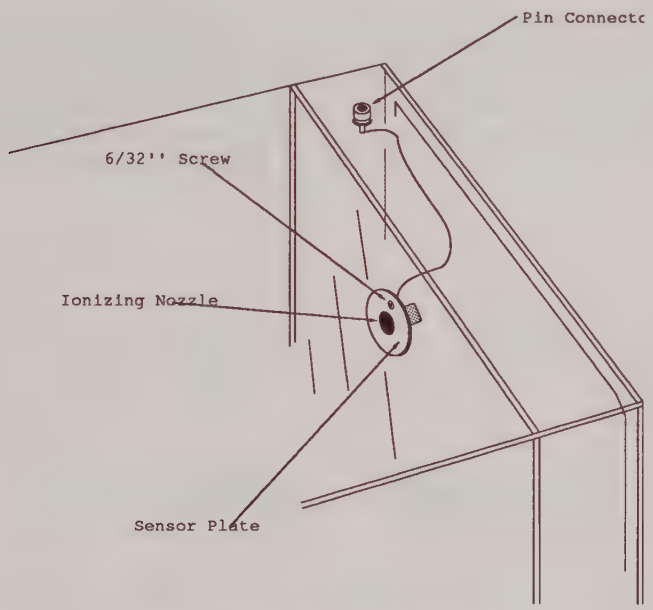


Figure 3.4
Sensor Plate Installing and Connecting

3.3 Applications with Ionizing Bars

In most applications, ionizing bars are factory mounted inside a glove box or beneath the HEPA filter assembly of a vertical laminar flow station or hood. As the filtered air flows out of the blower/filter housing, a portion of it passes through the ionizing nozzles inside the bar and carries a balanced charge of positive and negative ions to the work area.

The only connections necessary are the ground wire and the ionizing cable extensions (which are generally made before the unit leaves the factory.) Insert the spring-loaded connector of the extension (running from the ionizing bar) into the rear panel of the ionizing power supply. Then attach the grounding wire to the appropriate opening on the rear of this same panel. The ionizing equipment is turned on and off by means of the switch located on the main control panel (for the Vertical Laminar Flow Station, this is located on the top center of the main housing).

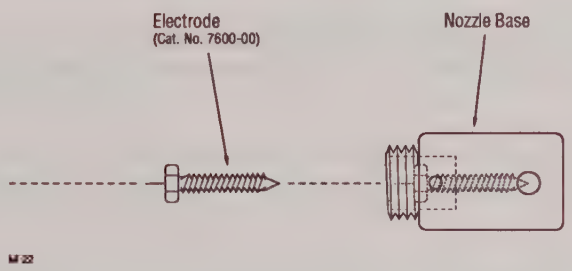
NOTE: Be sure that you use TUI's high-flux IonWatch Power Supply (Cat. No. 2003-02 or 2003-04) for ionizing bar.

4.0 Maintenance

The Automatic IonWatch power units typically require no maintenance. However, units should be tested periodically (depending on your particular application) to ensure that they are generating both positive and negative ions. Refer to the testing procedures in the Appendix below.

Ionizing Nozzles and Power Cable Extensions are constructed of non-oxidizing materials. The tungsten electrodes may, however, require some cleaning if they are exposed to particles (see Figure 4.1). Periodically, or if you nozzles fail to function properly, you should remove the electrode from each nozzle and inspect it for wear or particle accumulation.

Fig. 4.1
Electrode Construction



Newer TUI ionizing nozzles feature self-cleaning electrodes made of tungsten. If your nozzles feature the older electrodes, you can easily replace them with the new, improved ones. Contact TUI for ordering information.

Another cause of nozzle malfunction is a break in the extension cable. If a nozzle fails to emit ions, check any cable branches your set-up may use to make sure the screw connection has not broken the wire inside the cable. See Figure 3.3 above.

5.0 Troubleshooting

Problem: Ionizing Nozzles fail to emit ions.

Possible Solutions:

1. Check to make sure that the power unit is plugged in and turned on.

2. Check power cable extensions. Make sure that tips are clean and that all connections are good.

   Each power cable is equipped with a spring-loaded male jack; make sure that the spring is in place and that there is enough compression to complete a good connection with the female coupling (see Figure 3.2 above).

3. Check nozzle electrodes (see Section 4 above).

4. Power connections are made with a very thin tungsten wire. It is possible that this wire could be broken at some point along the ionizing circuit.

   To test for a broken wire, check each nozzle with an electrostatic locator. If you notice a break between two nozzles, replace the power extension between them.

5. In desiccator applications, make sure that nitrogen or air is being forced through the ionizing nozzles. Nozzles will not generate ions if the nitrogen supply is turned off.

6. If the ionizing equipment still does not function, then the power source may be bad. Call Terra Universal for assistance.

6.0 Specifications

Dimensions:	3" H x 11" W x 6 1/2" D
Weight:	6 lbs. 7 ozs.
Output Voltage:	10kV (models 2003-02 and 2003-03) 15kV (models 2003-02 and 2003-04)
Electrical Requirement:	110VAC/60Hz (models 2003-01 and 2003-02) 220VAC/50Hz (models 2003-03 and 2003-04)

7.0 Warranty

TUI warrants all of its ionizing equipment for a period of 90 days from the date of shipment and will, at the discretion of the Seller, either replace or repair without charge, F.O.B. Anaheim, any part of the equipment that, within the above stated time, is proved to have been defective at the time it was sold.

All equipment claimed defective must be returned, in its original packaging, properly identified to the Seller (or presented to one of its agents for inspection). All TUI products bear a name plate that features both catalog and serial numbers; to facilitate claims processing, the Buyer should identify any damaged or defective equipment by this serial number. TUI disclaims any product that does not bear this serial number.

TUI must be notified before any equipment is shipped for repair.

This warranty only applies to equipment operated in accordance with the Seller's operating instructions. This warranty becomes null and void should the equipment be abused or modified by the customer or if used in any application other than that for which it is specified.

Terra Universal will not assume responsibility for additional cost of repair due to damage incurred during shipping as a result of poor packaging.

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